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DIRECTORATE OF
INTELLIGENCE

Intelligence Report

The Competition for Scarce Scientific and Engineering Manpower in the USSR in 1975

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ER IR 72-6
April 1972

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INTELLIGENCE REPORT

THE COMPETITION FOR SCARCE SCIENTIFIC AND ENGINEERING MANPOWER IN THE USSR IN 1975

Introduction

1. Soviet research and development related to military and space programs is believed to have preempted a large share of the USSR's highly qualified scientific and technical manpower (HQM)[1]. Military and space demands for highly qualified manpower are believed to have been especially burdensome since the mid-1950s, when costly new weapons systems began to replace old systems at a rapid rate.

2. Assessment of the degree of tautness between the supply of and the demand for HQM has been hampered by Soviet reluctance to release the relevant data. Statistics on scientific manpower are very aggregative and include more than just R&D workers, and no information is published on the distribution of manpower between military and civilian R&D. Similarly, published budgetary figures are incomplete, very aggregated, and of uncertain coverage. Analysis of this problem has also suffered because there has been no accepted definition of HQM, such as that needed in military and space R&D. As a result, judgments regarding the changing impact of military demands for HQM on civilian R&D have been necessarily speculative.

1. Throughout this report, **military and space research, development, testing, and evaluation** are referred to as **military space R&D. Highly qualified manpower** comprises individuals having post-graduate degrees in the fields of chemistry, physics, mathematics, biology, and engineering. These five fields are referred to as **selected fields.** For a more detailed description of the term **highly qualified scientific and technical manpower,** see the section "Definition of Highly Qualified Scientific and Technical Manpower" in this report.

Note: This report was prepared by the Office of Economic Research and coordinated within the Central Intelligence Agency.

3. This report presents a definition of HQM, estimates the present size of this elite contingent, and projects changes in the supply of this manpower to the R&D sector between 1972 and 1975. The growth in demand for R&D manpower is appraised on the basis of planned expenditures for total R&D outlays, estimated rates of growth of its civilian and military components, and changes in the structure of R&D costs. A comparison of changes in the demand for and supply of HQM provides the basis for assessing whether the demands of military R&D are likely to be a growing burden on civilian R&D and on economic development.

Conclusions

4. Soviet expenditures on research and development are scheduled to rise rapidly during the Ninth Five-Year Plan (1971-75) -- from 11.7 billion rubles in 1970 to 19 billion rubles in 1975. The total demand of Soviet R&D programs for HQM is projected to increase at an annual rate of between 3-1/2% and 11% – to a range of 91,000 to 129,000 persons by 1975. The supply of these workers is also expected to rise rapidly -- 9-1/2% to 11-1/2% annually – producing a total supply by 1975 of 120,000 to 132,000. The projected growth rates are shown below in comparison with actual growth in the supply of HQM in R&D since 1955.

Period	Average Annual Rate of Growth (Percent)
1956-60	6
1961-65	7
1966-70	18
1971-75	
Projected demand	3-1/2 to 11
Projected supply	9-1/2 to 11-1/2

5. Although a shortage of HQM is a possibility by 1975, it would require an unlikely combination of a large increase in civil R&D relative to military R&D, low rates of cost increases in R&D, and a large demand for teachers in higher education. It is more likely that these factors will not be so strong as to create a shortage of manpower. The supply of HQM probably will be adequate to permit the level of military and space R&D desired by the leadership as well as increased manpower supplies for civilian R&D which has been in short supply since the mid-1950s. The lackluster performance of civilian R&D and the slow application of new technology

to industry has caused the leadership to express openly its lack of satisfaction with progress to date. If the projected supply of highly qualified personnel materializes, it will permit a much more rapid expansion in civilian R&D than over the last ten years.

Discussion

Definition of Highly Qualified Scientific and Technical Manpower

6. Soviet data on "scientific workers" **(nauchniye rabotniki)** include all persons performing R&D work or holding academic rank, many of whom do not have advanced degrees, as well as all workers with advanced degrees. Many scientific workers have only a VUZ[2] certificate (roughly equivalent to a US bachelor's degree), and in 1970 only 27% of all scientific workers held advanced degrees. Thoughout this report, **highly qualified scientific and technical manpower** is defined to include only those scientific workers with advanced degrees at the **kandidat** or **doktor** level.

[redacted] the Soviet candidate of sciences degree may be considered about equivalent to a US PhD and a Soviet doctor of sciences degree may be compared with a US PhD degree held by a mature scientist recognized for some original scientific contribution beyond and in addition to work for the degree. In most cases the granting of the candidate degree results after a successful defense of a dissertation which may come at the end of a formal 3-year program of graduate work. By requirements and tradition the Soviet doctoral degree is reserved for mature scholars most of whom are over 40 years of age.[3] 25X1

7. For the purpose of this report the definition of HQM is refined in two respects. First, the definition is limited to those scientific workers who hold **kandidat** or **doktor** degrees in chemistry, physics, mathematics, biology, and engineering. This group contains a large majority of the key scientific personnel. Second, the term HQM in R&D refers to

2. VUZ is the Soviet abbreviation for higher educational institution. VUZy is the plural form.

[redacted] 25X1

those not employed in higher educational institutions.[4] Removing the VUZ personnel understates the amount of HQM used in R&D work, since R&D performed by advanced-degree holders in universities and technical institutes would be ignored.[5] On the other hand, the number of HQM in R&D is overstated by the inclusion of personnel in non-academic, administrative positions. It is assumed that these two qualifications nearly offset each other.[6]

Supply of Highly Qualified Manpower to Research and Development in 1971-75

8. The supply of HQM in 1975 is estimated using relationships that simulate the normal progression of a student through his academic training. The formal procedure for earning the candidate of sciences degree is initiated when a graduate of a VUZ enters **aspirantura** training for three or four years. After completing this training the student is designated a "graduate," but he still must defend a dissertation to be granted the **kandidat** degree. A set of equations simulating these relationships was estimated and is described in detail in Appendix A. The result is a means of predicting the future stock of HQM, given the number of students enrolled in **aspirantura** training.

9. This predictive model looks ahead four years. That is, given an estimate of **aspirant** enrollment for 1971, the stock of HQM can be predicted for 1975. Enrollment has leveled in recent years and, based on that trend, 1971 enrollment is estimated as 100,000 as shown in the accompanying tabulation.

4. Many "scientific workers" are employed by both a VUZ and a research institute. Although the Soviet classification system is not fully understood, any distortion in the above data stemming from this factor is not likely to be large.

5. In September 1970 there were 805 VUZy. About 45 of these were universities; the remainder were institutes with various specialties which are here simply referred to as technical institutes.

6. Although a challengeable assumption, a large percentage error would have a small effect on the final analysis in this report. The most likely net direction of error would be to understate the supply of HQM to R&D.

	Thousand Persons		
1950	22	1967	97
1955	29	1968	98
1960	37	1969	100
1965	90	1970	99
1966	94	1971	100 a/

a. Estimated.

10. The use of the simulation model results in an estimate for 1975 of 200,000 scientific workers with advanced degrees in the selected fields (HQM). As shown in the tabulation below, this number represents a significant increase over earlier years.

	Persons
1955	40,452
1960	50,788
1965	72,328
1970	127,588
1975	200,000 a/

a. Estimated.

11. To arrive at the supply of HQM in the R&D sector, the total supply must be reduced by the number employed in higher educational institutions. The USSR, however, has not disclosed enough data to permit a direct estimate of the numbers of HQM employed by universities and technical institutes in 1975. Therefore, an estimating procedure has been devised which relates the student-teacher ratio to the proportion of HQM employed by VUZy and enrollment in VUZy (see Appendix B). From 1950 to 1965, enrollment in VUZy and the supply of HQM grew at similar rates and the percentage employed in VUZy remained essentially constant at

about 50%. Since 1965, the rate of growth of enrollment in VUZy has dropped sharply while the supply of HQM has continued to grow rapidly. As a result, the percentage of HQM in VUZy has also declined, to 40% in 1970, and is likely to continue to decline through 1975. Using projected enrollment figures and alternative assumptions about the student-teacher ratio, it is estimated that the percentage of HQM employed in VUZy in 1975 will fall in the range of 34% to 40%. This implies that the supply of HQM to R&D in 1975 will be between 120,000 and 132,000, as shown in the accompanying tabulation. This is an increase for 1971-75 of between 9.4% and 11.5% per year.

	Persons
1955	17,799
1960	23,870
1965	33,271
1970	76,553
1975	120,000 to 132,000 a/

a. Estimated.

Demand for Highly Qualified Manpower in Research and Development in 1971-75

12. The projected growth in demand for HQM through 1975 can be estimated indirectly by relating employment of HQM in R&D, total expenditures in R&D, and outlays per HQM in R&D. The starting point is the projected growth of total outlays for R&D – to 19 billion rubles in 1975, or about 10% per year between 1970 and 1975.(7) Next, outlays per HQM (capital investment, the purchase of supplies, and wages) are considered. Outlays per HQM in R&D depend on several factors underlying the composition and management of Soviet R&D:

(1) Military R&D tends to be more material intensive than civil R&D because of the emphasis on systems that often require large outlays on hardware. Soviet data are unavailable;

7. The 19 billion rubles in 1975 is not an announced goal; it results from the average annual growth rate that will exhaust the announced planned expenditures of 80 billion rubles for the 1971-75 plan period.

in the United States, expenditures per scientist and engineer are estimated to be 43% higher in military-related R&D than in civil R&D.[8] By use of separate ruble-dollar ratios for labor and material expenditures, this differential is estimated to be about 60% in the Soviet Union when expressed in ruble prices. Therefore, changes in the military and space share of R&D have a significant effect on outlays per HQM in R&D as a whole.

(2) Although temporal comparisons of Soviet R&D are not hindered to the same extent as US comparisons by price and wage increases, the salaries of Soviet R&D personnel are expected to increase sharply through 1975. Since salaries represent half of all R&D outlays, a continuation of the reported average annual increase of 3.2% in average earnings of employees in science and scientific services of the past few years would result in an annual increase of at least 1.6% in outlays per HQM. Larger salary increases combined with cost increases in materials and investment projects could cause an annual increase of as much as 5% per HQM.

(3) The leadership has declared repeatedly in speeches and in state decrees that Soviet R&D requires more equipment and more laboratory assistants to relieve scientists of routine work. To provide more equipment and supporting personnel would raise outlays per HQM, but it is not certain that these statements of intent have been translated into concrete results. Nevertheless, the possibility that outlays per HQM may rise on this account during the present five-year plan must be considered.

The considerations listed above serve as the basis for the alternative projections of demand for HQM in R&D in 1975. Within a given R&D budget, the demand for HQM will vary inversely with both the share of military R&D in total R&D and the average expenditure per HQM. Three variants of the share of military R&D in total employment of HQM engaged in R&D in 1975 are listed in Table 1: 75%, 58%, and 40%.[9] These

8. Estimated from US data for 1957-67. R&D in aircraft, missiles, and ordnance; electrical equipment and communications; and motor vehicles and other transportation equipment industries was taken to represent military-related R&D; all other industrial R&D was assumed to be civil.

9. In 1969, military and space R&D are roughly estimated to have represented 70% of total outlays. If outlays per HQM were 60% higher in military R&D than in civil R&D, the military share of HQM employed in all R&D would be 58%.

Table 1

USSR: Alternative Projections of Demand for Highly Qualified Manpower in Research and Development in 1975

Assumed average annual growth in outlays per HQM	Military Share of Employment of HQM in R&D in 1975 (Percent)	Demand for HQM in 1975 (Persons)	Average Annual Growth in Demand in 1971-75 (Percent)
1%	75	110,030	7.5
1%	58	118,247	9.1
1%	40	128,665	10.9
3%	75	99,753	5.4
3%	58	107,205	7.0
3%	40	116,650	8.8
5%	75	90,606	3.4
5%	58	97,376	4.9
5%	40	105,956	6.7

are the percentages that would prevail if employment of HQM in military R&D grew 2.2 times as fast, just as fast, or about half as fast, respectively, as employment of HQM in civil R&D during 1971-75. The stub entries of Table 1 represent alternative projections of the average annual percentage increase in cost per man in 1971-75: 1%, 3%, and 5%. An average increase of 1% would allow for some rise in salaries, while increases of 3% and 5% would permit a more generous provision of equipment, assistants, current supplies, and capital investment.

13. Thus, under these assumptions, designed to reflect the likely range of possibilities, the average annual increase in the demand for HQM in R&D will rise by 3.4% to 10.9% during 1971-75. A more rapid increase in employment of HQM in civil R&D than in military R&D will reduce the military share of employment of HQM and push the increase in demand for HQM in R&D toward the high side of the range. In other words, a ruble spent on civil R&D instead of military R&D goes further in employing

highly qualified people because not as much is required to support their work in civil R&D. On the other hand, the faster the growth in costs per man, the slower will be the growth in the demand for high-caliber people.

Relation of Supply and Demand for Highly Qualified Manpower in 1975

14. These estimates of demand and supply of HQM to R&D in 1975 indicate the probable future balance between them. As estimated above, the number of persons with advanced degrees in selected scientific and engineering fields who would be available for work in R&D in 1975 would be between 120,000 and 132,000. The demand for HQM in R&D projected above varied between 91,000 and 129,000. The difference ranges from a possible shortage of 9,000 to a surplus of 41,000 persons, or from -7% to 31% of the expected supply in 1975.

15. The projection of a shortage of HQM of 9,000 assumes that employment of HQM in civil R&D will grow about 50% faster than employment of HQM in military R&D from 1970 to 1975, that allocation of potential R&D workers to the education system will occur, and that the inflation rate will be very low. In other words, a combined shift toward civil R&D, a significant change in the teacher-student ratio in higher education, and very small wage and material cost increases are necessary for the demand for HQM to exceed the supply in 1975. This combination seems unlikely. The forecast of a probable surplus does not preclude a shortage in a particular field. For example, it is possible for an overall surplus to contain a shortage of chemists and a very large surplus of engineers.

16. If a sizable shift toward civil R&D does not occur, there should be more than enough HQM to go around, unless allocations for spending on science are increased. This does not mean that people with advanced degrees would be unemployed or forced into other lines of work, as in recent American experience. Instead, institutes and design bureaus would probably be given quotas to absorb above their real needs, and the universities would be able to upgrade the quality of their teaching staff. In either case, unless budget ceilings were lifted, the average level of support given to top-level personnel in the form of supplies or assistance would have to fall.

17. Thus the competition between military R&D and civil R&D for scarce human resources should ease over the next five years. The momentum of past enrollments in graduate training will continue to cause very large increments in the stock of persons with advanced degrees in selected scientific and engineering fields. And, unless the announced figure for expenditures on science in the Ninth Five-Year Plan is spurious, the supply

of these graduates available to civil R&D should rise -- either because a shift in the proportion of future graduates assigned to civil R&D has already been planned or because the available supply of HQM will outrun the expected demand associated with the current allocation of R&D funds between civil and military R&D.

APPENDIX A

Derivation of Equations Relating Stock of Highly Qualified Manpower to Enrollment in Aspirant Training

To predict the stock of highly qualified manpower, a model comprising three basic relations was constructed. First, the number of students completing aspirant training (G) – see Table 2 – was regressed against the enrollment in aspirant training (A). The best relation obtained was

Equation: $G_t = -297 + 0.267A_{t-2}$

(1) Standard errors: (170) (0.003)

Test statistics: $\bar{R}^2 = 0.997$ Number of observations NOB = 24

The second equation, regressing increases in the stock of scientific workers with advanced degrees (see Table 3) against the number of completions of aspirant training was estimated with different lags between completions of aspirant training (G) and changes in the stock of persons with advanced degrees ($S_t - S_{t-1}$). The best regression was

Equation: $S_t - S_{t-1} = 944 + 0.850G_{t-2}$

(2) Standard errors: (1395) (0.108)

Test statistics: $\bar{R}^2 = 0.794$ NOB = 18

The third equation relates scientific workers with advanced degrees in selected fields (S*) to the total number of scientific workers with advanced degrees (S).

Equation: $S^*_t = -9181 + 0.549S_t$

(3) Standard errors: (485) (0.003)

Test statistics: $\bar{R}^2 = 0.9997$ NOB = 13

Table 2

USSR: Aspirant Training a/

Persons

Year	In Training: Total	In Training: In Selected Fields b/	Completed Training	Cummulative Completions
1945	9,800	N.A.	1,366	1,366
1946	14,700	N.A.	1,616	2,982
1947	15,800	N.A.	2,730	5,712
1948	17,300	N.A.	3,328	9,040
1949	19,400	N.A.	4,528	13,568
1950	21,905	9,347	4,093	17,661
1951	24,800	N.A.	4,895	22,556
1952	26,704	N.A.	5,682	28,238
1953	29,162	N.A.	6,495	34,733
1954	30,800	N.A.	6,796	41,529
1955	29,362	14,957	7,607	49,136
1956	25,495	N.A.	8,453	57,589
1957	22,236	N.A.	8,250	65,839
1958	23,084	13,833	6,802	72,641
1959	28,644	17,005	5,603	78,244
1960	36,754	21,650	5,517	83,761
1961	47,560	27,914	6,921	90,682
1962	61,809	36,185	8,515	99,197
1963	73,105	43,725	11,660	110,857
1964	83,271	51,324	15,320	126,177
1965	90,294	57,200	19,240	145,417
1966	93,755	N.A.	21,820	167,237
1967	96,779	61,659	23,618	190,855
1968	98,139	62,143	25,488	216,343
1969	99,532	62,623	25,810	242,153
1970	99,427	62,478	25,870	268,023

a. Aspirantura *training for graduates of higher educational institutions.*
b. The selected fields are chemistry, physics, mathematics, biology, and engineering.

Table 3

USSR: Composition of Scientific Workers a/

Persons

Year	Total	With Advanced Degrees	In Selected Fields (HQM) b/ Total	In Selected Fields (HQM) b/ With Advanced Degrees
1947	145,600	44,600	N.A.	N.A.
1948	N.A.	N.A.	N.A.	N.A.
1949	N.A.	N.A.	N.A.	N.A.
1950	162,508	53,807	73,246	N.A.
1951	N.A.	N.A.	N.A.	N.A.
1952	179,052	62,200	N.A.	N.A.
1953	191,885	68,000	N.A.	N.A.
1954	210,200	78,200	N.A.	N.A.
1955	223,893	87,421	108,628	40,452
1956	239,880	95,420	N.A.	N.A.
1957	261,571	97,200	N.A.	N.A.
1958	284,038	100,242	148,121	45,886
1959	310,022	104,529	168,126	48,383
1960	354,158	109,207	200,137	50,788
1961	404,126	113,775	235,385	52,884
1962	524,546	120,656	296,645	58,181
1963	565,958	127,984	353,007	60,977
1964	611,964	137,616	384,780	66,486
1965	664,584	149,184	423,282	72,328
1966	712,419	169,042	449,220	83,043
1967	770,013	187,585	488,180	93,390
1968	822,910	206,433	521,760	103,982
1969	883,420	227,247	560,301	115,722
1970	927,709	248,106	587,899	127,588

a. Nauchniye rabotniki *in Soviet reporting.*
b. The selected fields are chemistry, physics, mathematics, biology, and engineering.

The fit of the second equation is considerable less precise than the first and third equations. This reflects the fact that a large proportion, as much as 50%, of the people awarded the **kandidat** degree are not graduates of formal **aspirantura** training. In such cases, academic personnel are allowed to substitute work experience for the **aspirantura** training. If the percentage of **kandidat** degrees awarded to non-aspirant personnel is constant over time, then the regression would not be affected. There is enough evidence available to suggest that significant fluctuations have occurred, but not enough to correct for this feature. Hence the equation was used in its present form.

Equations (1) - (3) can be combined into one equation:

$$S^*_t = a + b\ S_{t-1} + c\ A_{t-4}$$

Equation (2) can be lagged and repeatedly substituted into this equation to develop the estimating equation.

Equation: $S^*_t = -19{,}063 + 0.616 S_{t-5} + 0.142 \left(\sum_{i=t-8}^{t-4} A_i \right)$

(4) Standard errors: (6,242) (0.092) (0.022)

Test statistics: $\overline{R}^2 = 0.987$ NOB = 13

This equation produces an estimate of 203,000 HQM for 1975. Equation (4) could also be solved using coefficients derived from equations (1) - (3) instead of estimating them directly. This produces a lower estimate of 192,000 HQM in 1975. The direct method is believed to be somewhat more reliable, and a compromise figure of 200,000 was used.

APPENDIX B

Derivation of the Proportion of Highly Qualified Manpower Employed in Higher Educational Institutions in 1975

The USSR has not disclosed the numbers employed by universities and technical institutes since 1960,[10] but an indicator of the change in the share of HQM occupied in higher education can be based on student-teacher ratios and enrollments. In computing the student-teacher ratio, use of total enrollment in VUZy could introduce distortions because of changes in the structure of enrollment. A student may enroll in the full-time day division or in the part-time evening and correspondence divisions. Therefore, the student-teacher ratio was computed on the basis of a full-time equivalent enrollment as well as the unadjusted total enrollment. To derive a full-time equivalent enrollment, factors reflecting different student-teacher ratios of 0.5 for evening enrollment and 0.3 for correspondence enrollment were used. Table 4 is based on these factors.

Several projections of enrollment in 1975 were computed. Since 1965 the rate of growth of enrollment has been declining, and in 1969 and 1970 there were absolute decreases in the evening and correspondence divisions (see Table 5). It is expected that enrollment will continue to grow slowly in 1971-75.[11] To account for a range of possibilities, three assumptions were tested: The first alternative assumes an average annual growth of 3% in all three divisions; the second alternative assumes 5% growth per annum; the third assumption is that day enrollment will grow at an average annual rate of 7.2% (the same as for 1966-70) and that evening and correspondence enrollment will remain at the 1970 level. The third assumption results in an average annual growth of 3.8% on a total enrollment basis and 5.4% on a full-time equivalent basis. Assuming alternative student-teacher ratios, the percentage of HQM employed in VUZy can be calculated. Using ratios between 27.0 and 31.0 on a full-time equivalent basis, it is estimated that this percentage could fall as low as 30% in 1975, or remain close to the 40% figure for 1970. Similar results were obtained on a total enrollment basis.

10. **Izvestiya** of 22 January 1972 states that 40% of advance-degree holders are employed in VUZy. Assuming that this figure is for 1970 or 1971, an employment number can be computed.

11. This is corroborated by data on admissions to VUZy to 1970 and planned admissions for 1971-75. The growth rate of actual and planned admissions from 1966 to 1973 is only 0.5% per year.

Table 4

USSR: Student-Teacher Ratio in Higher Education

Year	Scientific Workers with Advanced Degrees Employed in VUZy	Enrollment in VUZy a/	Student-Teacher Ratio
1950	28,873	952,200	33.0
1955	48,997	1,379,200	28.1
1959	55,938	1,521,300	27.2
1960	57,878	1,576,500	27.2
1970	99,242	3,074,600	31.0

a. These data are for enrollment in all fields. It would be desirable to use data on enrollment in just the selected fields, but these are not reported. Since 1960, however, a rough division of enrollment into "technical" subjects and "others" (economics, law, etc.) shows little change in their relative proportions.

If, on the other hand, it is assumed that the proportion of HQM in VUZy remains at the 1970 level, the effect on the student-teacher ratio can be examined. In all cases, the ratio must fall. The amount varies from a small 3.5% drop to a very substantial 25%.

Thus it seems likely that the percentage of HQM employed by VUZy will decline between 1970 and 1975, but possibly only slightly. Therefore, a range of 34% to 40% is used. Applied to the estimate of 200,000 total HQM in 1975, this implies that there will be between 120,000 and 132,000 HQM available to the R&D sector.

Table 5

USSR: Enrollment in Higher Education

Thousand Persons

Year	Total	Day	Evening	Correspondence
1950	1,247.4	817.9	27.2	402.3
1951	1,306.1	836.1	32.1	437.9
1952	1,441.5	933.6	37.9	470.0
1953	1,562.5	994.4	48.3	519.8
1954	1,730.5	1,084.1	62.4	584.0
1955	1,867.0	1,147.0	80.9	639.1
1956	2,001.6	1,177.7	100.8	723.1
1957	2,099.1	1,193.1	127.2	778.8
1958	2,178.9	1,179.6	153.3	846.0
1959	2,267.0	1,145.8	195.8	925.4
1960	2,395.5	1,155.5	244.9	995.1
1961	2,640.0	1,204.0	307.0	1,129.0
1962	2,944.0	1,287.0	374.0	1,283.0
1963	3,261.0	1,383.0	439.0	1,439.0
1964	3,608.0	1,514.0	506.0	1,588.0
1965	3,861.0	1,584.0	569.0	1,708.0
1966	4,123.0	1,740.0	618.0	1,765.0
1967	4,311.0	1,890.0	652.0	1,769.0
1968	4,470.0	2,029.0	670.0	1,771.0
1969	4,550.0	2,140.0	668.0	1,742.0
1970	4,581.0	2,241.0	658.0	1,682.0